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PREDICTORS OF BEHAVIOR AND PERFORMANCE DURING LONG DURATION SPACE MISSIONS: THE ANTARCTIC – SPACE ANALOG PROGRAM (ASAP)

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INTRODUCTION

It is generally acknowledged that long duration space missions will require crewmember personality and social characteristics that differ substantially from those required for short duration missions. However, small sample sizes and relatively few long duration missions have made the identification of such characteristics in astronaut personnel somewhat problematic. Studies of personnel in analog environments such as Antarctic research stations allow for a determination of the characteristics of ideal candidates for long duration missions.

METHODS

The influence of crewmember personality and social characteristics, station size and severity of station environment on measures of behavior and performance at the end of the austral winter was examined in 657 American men who wintered over as members of 42 different expeditions at 8 Antarctic research stations between 1963 and 1974. Personality characteristics were based on subscales of a survey designed for winter-over personnel that assessed the following: 1) attitudes toward the antarctic environment (motivation, job importance, boredom, confidence in organization, confidence in medical care); 2) common psychological needs (achievement, autonomy, nurture, and orderliness); 3) self-descriptions (decisiveness, excitability, bluntness, and absentmindedness), and 4) desired characteristics of friends (efficiency, sympathy, conservatism, optimism, dignity, cynicism, adventurousness). The FIRO-B scale was used to measure two aspects (expressing and wanting) of three interpersonal needs (inclusion, control and affection). Social characteristics included age, marital status, military/civilian status, education, and years in occupation. Station environment was determined on the basis of crew size, latitude, altitude, and mean annual temperatures. Performance was assessed by means of self reports of depressive symptoms, based on RDC criteria; peer nominations of crewmembers to winter-over at a small station; and combined peer-supervisor evaluations of task performance (ability), emotional well-being (stability), participation in social relations (compatibility), leadership, and overall performance. Predictors were entered into two-step hierarchical regression models with forced entry of social-demographic characteristics and stepwise selection of psychological and environmental variables.

RESULTS

Significant independent predictors of depression at the beginning of the austral winter included the following: high levels of boredom ($r = .14$, $p < 0.01$); desired cynicism in friends ($r = .12$, $p < 0.05$); small crew size ($r = -.11$, $p < 0.05$); and being currently married ($r = .24$, $p < 0.001$). Significant independent predictors of depression at the end of winter included the following: depression at the beginning of winter ($r = .51$, $p < 0.001$); less severe station environments ($r = -.11$, $p < 0.05$); and high levels of boredom ($r = .21$, $p < 0.001$) and motivation ($r = .09$, $p < 0.05$).

Significant predictors of the percent of station crew who nominated an individual to winter-over again included: size of crew ($r = -.47$, $p < 0.001$); high desire for optimism ($r = .18$, $p < 0.001$) and low desire for efficiency ($r = -.12$, $p < 0.05$) in friends; low levels of boredom ($r = -.14$, $p < 0.01$) and high levels of motivation ($r = -.10$, $p < 0.05$); a need to be controlled by others ($r = .11$, $p < 0.05$); and military service ($r = .13$, $p < 0.05$). Combined peer –supervisor evaluations of task ability were independently associated with a low need for affection from others ($r = -.17$, $p < 0.001$) and orderliness ($r = -.14$, $p < 0.01$); low levels of boredom ($r = -.12$, $p < 0.05$); and a high desire for optimism ($r = .18$, $p < 0.01$) but a low desire for efficiency ($r = -.12$, $p < 0.05$) in friends. Evaluations of emotional stability were independently associated with a low need for affection from others ($r = -.12$, $p < 0.05$); military service ($r = .13$, $p < 0.05$); and low levels of boredom ($r = -.10$, $p < 0.05$). Evaluations of social compatibility were independently associated with a low need for achievement ($r = -.15$, $p < 0.001$) and affection from others ($r = -.11$, $p < 0.05$); military service ($r = .13$, $p < 0.05$); low levels of boredom ($r = -.10$, $p < 0.05$); and a desire for optimism ($r = .14$, $p < 0.01$) in friends. Evaluations of leadership were independently associated with marital status ($r = .16$, $p < 0.01$); low absentmindedness ($r = -.13$, $p < 0.01$); a need to control others ($r = .10$, $p < 0.05$); and high levels of motivation ($r = .12$, $p < 0.05$). Evaluations of overall performance were independently associated with military service ($r = .16$, $p < 0.01$); a low need for affection from others ($r = -.13$, $p < 0.01$) and orderliness ($r = -.13$, $p < 0.01$); and low levels of boredom ($r = -.11$, $p < 0.05$).

CONCLUSION

Ideal candidates for long-duration missions appear to have the following characteristics: low levels of depression at the beginning of winter, boredom, and a desire for affection from others; a low need for achievement and orderliness; a high need for optimism but a low need for efficiency in others; and military service. Leaders of such missions should be married, highly motivated, and express a need for control over others. The low need for personal achievement and orderliness, affection from others and efficiency in friends may reflect characteristics that are uniquely suited to the prolonged isolation, confinement, and unique environmental characteristics of Antarctic research stations. Highly motivated personnel in small stations may also experience depressive symptoms at various points during an extended mission in an isolated, confined environment due to the absence of opportunities and resources to meet social and psychological needs. The emphasis placed on military service in the evaluations by peers and supervisors may reflect a bias inherent in small groups where military or civilian personnel comprise the majority of both station leaders and crewmembers.